



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/712,775 | 11/14/2003 | Donggyun Han | 2557-000216/US | 7409 |

30593 7590 03/17/2006

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER

ALANKO, ANITA KAREN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 03/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/712,775

Applicant(s)

HAN ET AL.

Examiner

Anita K. Alanko

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12/29/05 amdt.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 and 51-60 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-30 and 51-60 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/29/05.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Drawings

Figures 2, 3A-3B, and possibly Figures 4 and 10 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claim 13 is objected to because of the following informalities: the term "normal" does not further limit the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-9, 13-15, 19, 21-23, 29-30, 51-53, 55, 57-59 are rejected under 35 U.S.C. 102(e) as being anticipated by Vaartstra (US 6,770,426) as evidenced by Chandra et al (US 2002/0014257 A1) or WO 02/11191 A2.

Vaartstra discloses a method comprising:

sequentially treating the photoresist with a first reactant (supercritical carbon dioxide, col.5, lines 55-56) to cause swelling, cracking or delamination of the photoresist (since it is the same reactant as in the instant invention, the same results such as swelling are expected as evidenced by Chandra ([0078]) or WO 02/11191 A2 (page 26, line 1));

treating the photoresist with a second reactant (ozone, col.5, line 32) to chemically alter the photoresist (since it is the same reactant as in the instant invention, the same results such as chemically altering are expected, as evidenced by WO 02/11191 A2 (see page 26, lines 1-3)); and

subsequently removing the chemically altered photoresist with a third reactant ("one or more additional components" col.5, lines 43-44, e.g., water, col.5, line 56, or alternatively the third reactant may be the same as either the first or second reactant).

The term "sequentially treating" is interpreted broadly- the treating steps may be in any order. However, Vaartstra inherently has treating with a first reactant, to cause swelling. Thereafter, the swelling allows for the subsequent, second treatment to be successful, i.e., for chemically treating or oxidizing (as evidenced by WO 02/11191 A2 at page 26, lines 1-3).

As to claim 19, the steps are not limited to any specific order, therefore, as broadly cited, Vaartstra discloses all of the steps. As to the amended limitation that injecting the first reactant

Art Unit: 1765

and the second reactant are performed sequentially, Vaarstra discloses that the ozone is in the supercritical state, but allows for the option that ozone is not supercritical (col.5, lines 45-47):

At least one of the one or more additional components must be in the supercritical state if an oxidizer component is not in the supercritical state

Ozone is the oxidizer component (col.5, line 33) and another component is supercritical carbon dioxide (col.5, lines 51-56).

Vaarstra also discloses that (col.6, lines 32-40):

...a component not in a supercritical state may be added to a supercritical component ...**after** it is brought to the supercritical state; a component not in a supercritical state may be provided **into an etching chamber** **while** the substrate is being exposed to the supercritical oxidizer component

Thus, since ozone is a component not in a supercritical state, Vaarstra discloses to inject the first and second reactants sequentially.

Claims 1-2, 4, 6-8, 11-16, 19-21, 23-24, 28-30, 51-60 are rejected under 35 U.S.C. 102(e) as being anticipated by Mullee (US 6,306,564) as evidenced by Chandra et al (US 2002/0014257 A1) or WO 02/11191 A2.

Mullee discloses a method comprising:

sequentially treating the photoresist with a first reactant (supercritical carbon dioxide, col.4, lines 37-39) to cause swelling, cracking or delamination of the photoresist (since it is the same reactant as in the instant invention, the same results such as swelling are expected as evidenced by Chandra ([0078]) or WO 02/11191 A2 (page 26, line 1));

treating the photoresist with a second reactant (ozone, col.4, line 15) to chemically alter the photoresist (since it is the same reactant as in the instant invention, the same results such as chemically altering are expected, as evidenced by WO 02/11191 A2 (see page 26, lines 1-3)), (col.4, lines 58-60, e.g. the two removal steps (col.4, lines 67-col.5, line 1) encompass sequential treating steps); and

subsequently removing the chemically altered photoresist with a third reactant (deionized water, col.5, lines 17-23).

The term “sequentially treating” is interpreted broadly- the treating steps may be in any order. However, Mullee inherently has treating with a first reactant, to cause swelling. Thereafter, the swelling allows for the subsequent, second treatment to be successful, i.e., for chemically treating or oxidizing (as evidenced by WO 02/11191 A2 at page 26, lines 1-3).

As to claim 19, the steps are not limited to any specific order, therefore, as broadly cited, Mullee discloses all of the steps. Note that reactants are not defined, and therefore the first and second reactant can be the same, for example an ozone and supercritical carbon dioxide mixture.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vaartstra (US 6,770,426) in view of Liu and Shibata.

The discussion of Vaartstra from above is repeated here.

As to claim 3, Vaartstra does not disclose the dosage of the ion implantation. Liu and Shibata teach that ion implantation at the cited dosages are useful to enable the usage of thinner photoresists, which is useful for forming interconnections (see abstracts). It would have been obvious to use the cited dosage in the method of Vaartstra because Liu and Shibata teach that they are useful to enable the usage of thinner photoresists, which is useful for forming interconnections.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,770,426) in view of Vaartstra (US 6,770,426), Liu and Shibata.

The discussion of Mullee from above is repeated here.

As to claim 3, Mullee does not disclose ion implantation. However, Mullee discloses that the photoresist to be removed includes that used for the manufacture of semiconductor devices. Vaartstra teaches that ion-implanted resists are commonly formed during the manufacture of

semiconductor devices (col.6, line 56). Liu and Shibata teach that ion implantation at the cited dosages are useful to enable the usage of thinner photoresists, which is useful for forming interconnections (see abstracts). It would have been obvious to use the cited dosage in the method of Mullee because Vaarstra teaches that resist to be removed includes ion-implanted resist and Liu and Shibata teach that the dosages cited are useful to enable the usage of thinner photoresists, which is useful for forming interconnections.

Claims 5, 17 and 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,770,426) in view of Vaartstra (US 6,770,426).

The discussion of Mullee from above is repeated here.

As to claims 5, 17 and 22, Mullee discloses a pressure range of 2000-6000 psi that encompasses the cited pressure range (col.3, line 62 - col.4, line 3), however Mullee discloses a temperature of up to 80 °C (col.4, line 2), which is lower than the cited range of 100-150 °C.

Vaartstra teaches that a useful temperature range for using supercritical gases to remove photoresist includes 30 – 250 °C (col.7, line 58), which encompasses the cited range of 100-150 °C. It would have been obvious to one with ordinary skill in the art to operate at the cited temperature range in the method of Mullee because Vaartstra teaches that this is a useful temperature range for using supercritical gases to remove ion-implanted photoresist.

Claims 9-10, 18, 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mullee (US 6,770,426).

The discussion of Mullee from above is repeated here.

As to claims 9-10, 18, 25-27, Mullee does not disclose the parameters of the ozone, however temperature, pressure and concentration are all variables that effect how quickly ozone can chemically react. Thus, it would have been obvious to one with ordinary skill to operate at the cited parameters in the method of Mullee in order to get a process that works to effectively remove photoresist, or because they appear to reflect result-effective variables which can be optimized. See MPEP 2144.05 IIB.

Claims 7-10, 24, 27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaartstra (US 6,770,426) in view of Tipton et al (US 6,800,142 B1) and Masuda et al (US 2004/0198627 A1).

The discussion of Vaartstra from above is repeated here.

As to claims 7-9, as broadly cited, Vaartstra discloses to use ozone vapor with the carbon dioxide at the cited temperatures and pressures. However, Tipton also teaches that it is useful to separate an ozone reactant (col.6, lines 3-4, col. 12, lines 9-10) from the supercritical carbon dioxide reactant (col.6, lines 3-5) enables the ozone reactant to be more concentrated, the supercritical fluid application to be more effective and increases the overall efficiency of the process (col.1-15). It would have been obvious to one with ordinary skill in the art to separate the ozone and supercritical carbon dioxide fluids from one another and apply in separate steps in the method of Vaartstra because Tipton teaches that this enables the ozone reactant to be more concentrated, the supercritical fluid application to be more effective and increases the overall efficiency of the process.

Further, as to claims 9-10, it would have been obvious to one with ordinary skill in the art to use the cited temperatures, pressures and concentration because they determine how much active species are available for the reaction, and therefore they appear to reflect result-effective variables which can be optimized. See MPEP 2144.05 IIB.

Claims 11-12, 16-17, 28, 54, 56 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaartstra (US 6,770,426) in view of Masuda et al (US 2004/0198627 A1).

The discussion of Vaartstra from above is repeated here.

As to claims 11-12, 16, 28, 54, 56 and 60, Vaartstra does not disclose to rinse with deionized water. Masuda teaches that after a supercritical carbon dioxide process, that it is useful to rinse with water to remove residues (page 4, Table 5, Run 8). It would have been obvious to one with ordinary skill in the art to rinse with deionized water in the method of Vaartstra because Masuda teaches that this is useful after supercritical processes to remove residues, which increases the yield of the final product.

Claims 18, 20, 25-26 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaartstra (US 6,770,426) in view of Tipton et al (US 6,800,142 B1) and Masuda et al (US 2004/0198627 A1).

The discussion of Vaartstra from above is repeated here.

As to claim 18, see the rejection of claim 9.

As to claim 20, the method of Vaartstra modified by Tipton uses different steps for the first reactant and the second reactant. It would have been obvious to do this in different

Art Unit: 1765

chambers, with depressuraization and purging as cited, in the modified method of Vaartstra in order to enable each chamber to be optimized for each step.

As to claims 25-26, it would have been obvious to one with ordinary skill in the art to use the cited temperatures because the temperature determines how much active species are available for the reaction, and therefore it appears to reflect a result-effective variable which can be optimized. See MPEP 2144.05 IIB.

As to claim 30, since the method has the same steps as the instant invention, it is expected to have the same results of water solubility.

Response to Amendment

The IDS filed December 29, 2005 has been considered. The reference to Shimada appears to be in error as it is not related to the instant invention, thus Shimada has not been considered.

Applicant's indication that the drawings are to be labeled "Conventional art" is acceptable, but the drawings have not yet been received.

The claims remain rejected over Vaartstra, and newly rejected over Mullee, which was newly cited in the IDS filed on December 29, 2005.

Claim 13 is objected to for minor informalities.

Response to Arguments

Applicant's arguments filed December 29, 2005 have been fully considered but they are not persuasive.

As to amended claim language, applicant argues that the claims cite that the reactants are “applied to the photoresist sequentially (albeit in all different orders) or sequentially in a specific order”. Examiner thus broadly interprets claim 1 in that the treating steps with the first and second reactants may occur in any order. Still further, although they are sequential, they may overlap in time. Since the claims have open “comprising” language, the reactants have not been defined, and thus they may be the same reactants (or one composition that includes many reactants).

Thus, applicant’s arguments about the compositions in Vaarstra are not persuasive since the claims are open to multiple steps at multiple or overlapping times which are also sequential, with reactants that may be the same composition.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

Art Unit: 1765

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K. Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko
Anita K Alanko
Primary Examiner
Art Unit 1765